



**July 2007
HSC Course
Trial Examination**

GENERAL MATHEMATICS

General instructions

- Reading Time – 5 minutes
- Writing Time – 2½ hours
- Write using blue or black pen
- Calculators may be used.
- A formulae sheet is provided at the back of this paper

Section 1

Total Marks (22)

- Attempt Questions 1 – 22
- Allow about 30 minutes for this section

Section II

Total marks (78)

- Attempt Questions 23 – 28
- Allow about 2 hours for this section

Section 1

Total marks (22)

Attempt Questions 1 – 22

Allow about 30 minutes for this section

Use the multiple choice answer sheet.

Select the alternative A, B, C or D that best answers the question. Fill in the response oval completely.

Sample $2 + 4 =$ (A) 2 (B) 6 (C) 8 (D) 9
 A ☐ B ☒ C ☐ D ☐

If you think you have made a mistake, put a cross through the incorrect answer and fill in the new answer.

A ☒ B ☒ C ☐ D ☐

If you change your mind and have crossed out what you consider to be the correct answer, then indicate this by writing the word *correct* and drawing an arrow as follows.

correct
 A ☒ B ☒ C ☐ D ☐

Answer sheet for Section 1

- | | | | | |
|-----|-------------------------|-------------------------|-------------------------|-------------------------|
| 1. | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| 2. | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| 3. | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| 4. | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| 5. | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| 6. | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| 7. | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| 8. | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| 9. | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| 10. | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| 11. | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| 12. | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| 13. | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| 14. | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| 15. | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| 16. | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| 17. | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| 18. | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| 19. | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| 20. | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| 21. | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| 22. | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |

1. The distance of the Earth from the sun is approximately 142 million kilometres. Expressed in scientific notation this is equal to:

(A) 1.42×10^6 (B) 1.42×10^8
(C) 1.42×10^9 (D) 142×10^6

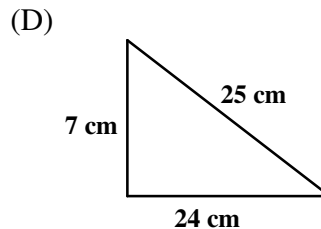
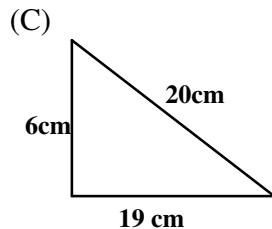
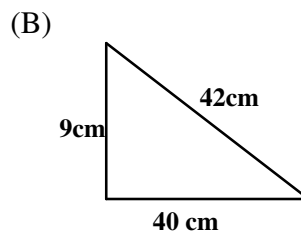
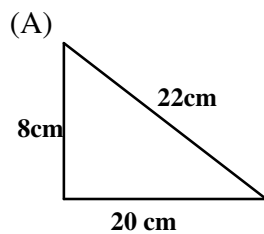
2. For the set of scores 2, 4, 5, 5, 6, 9, 9, 9 the median and mode are:

(A) Median = 5, Mode = 5 (B) Median = 5.5, Mode = 5
(C) Median = 5, Mode = 9 (D) Median = 5.5, Mode = 9

3. Which of the following is the correct simplification of $9x^4 - 4x^4$?

(A) 5 (B) $5x$ (C) $5x^4$ (D) $5x^8$

4. Which of the following triangles drawn below is right-angled?



5. Mohammed invests \$12 000 in a fixed term deposit that pays 6% p.a. simple interest over a three year term.

The value of Mohammed's investments on maturity is:

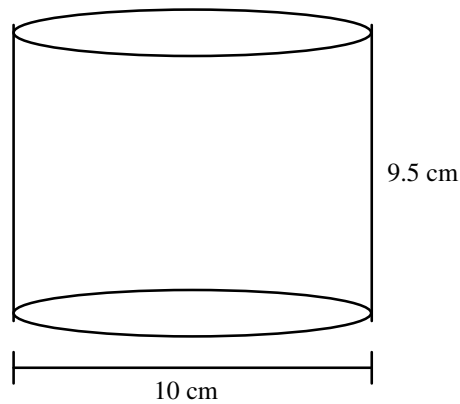
(A) \$2160.00 (B) \$2292.19
(C) \$14 160.00 (D) \$14 292.19

6. A game is played where a die is rolled. It costs \$1 to play and the player rolls the die and records whatever number they roll. The die is then rolled again. If they roll the same number they are paid \$3 and if they roll a six they receive their \$1 back. (The player receives both payments if the initial roll is a six.)

The financial expectation from this game is:

(A) $-\$0.34$ (B) $-\$0.67$
(C) $\$0.34$ (D) $\$0.67$

7. A cylindrical canister has a diameter of 10 cm and a height of 9.5 cm.



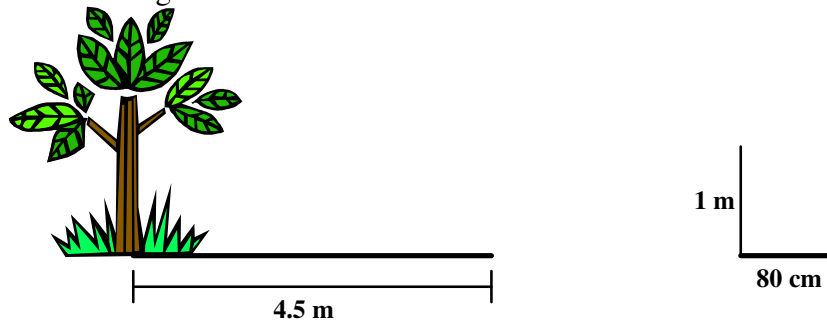
The capacity of the canister is closest to:

- (A) 750 mL
(B) 1.5 L
(C) 3 L
(D) 6 L
8. Simplify $5(4x - 3) - 6(2x + 5)$
- (A) $8x - 45$
(B) $8x + 15$
(C) $32x - 45$
(D) $32x + 15$
9. A \$300 000 loan is to be taken out. Which of the following loans will have the lowest total cost?
- (A) 4% p.a. flat rate interest to be repaid over 20 years.
(B) 8% p.a. reducible interest to be repaid over 20 years at \$2509.32
(C) 9% p.a. reducible interest to be repaid over 15 years at \$3042.80
(D) 8.5% p.a. reducible interest to be repaid over 15 years at \$3024.98 per month with a \$900 application fee and a \$12 per month account keeping fee.
10. Wilma is collecting data for a study on what type of take-away food outlet should be set up in her local area. To choose the participants in her survey Wilma selects equal numbers of males and females and ensures that the number of people in each age bracket is in the same proportion to the overall population. This is an example of:
- (A) a stratified sample
(B) a systematic sample
(C) a random sample
(D) a discrete sample

11. Amanda invests \$2000 per year for 20 years into an annuity. The interest rate is 6.5% p.a. and interest is compounded annually.
The future value of the annuity is:

(A) \$7047.30 (B) \$22 037.02
(C) \$37 650.62 (D) \$77 650.62

12. A tree casts a shadow, 4.5 metres long. At the same time a metre ruler casts a shadow 80 cm long.



The height of the tree will be approximately:

(A) 3.6 metres (B) 4 metres
(C) 5 metres (D) 5.625 metres

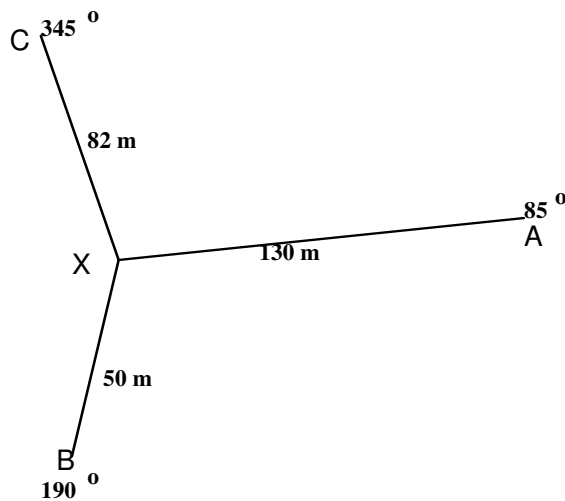
13. The scores below represent the number of days absent that Ashton has been away from school in each of the past 12 years.

0 1 2 4 5 5 8 9 10 12 12 20

The interquartile range of the data is:

(A) 3 (B) 8 (C) 10 (D) 20

14. The figure below shows a compass radial survey.



The area of $\triangle AXC$ correct to the nearest 10 m^2 is?

- (A) 5000 m^2 (B) 5010 m^2
(C) 5240 m^2 (D) 5250 m^2

15. Which of the following function is **NOT** a quadratic function?

- (A) $y = x^2$ (B) $y = 4x$
(C) $y = x^2 + 4x$ (D) $y = x^2 + 4$

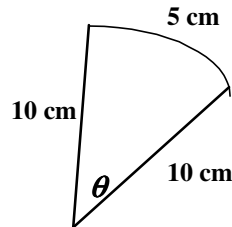
16. The table below shows the rates of PAYE tax payable on a range of incomes.

Taxable income	Tax on this income
\$0 – \$6,000	Nil
\$6,001 – \$21,600	15c for each \$1 over \$6,000
\$21,601 – \$63,000	\$2,340 plus 30c for each \$1 over \$21,600
\$63,001 – \$95,000	\$14,760 plus 42c for each \$1 over \$63,000
Over \$95,000	\$28,200 plus 47c for each \$1 over \$95,000

Charlie has a taxable income of \$75 000. The amount of PAYE tax payable on this amount of money is:

- (A) \$14 760 (B) \$18 360
(C) \$19 800 (D) \$31 500

17. The figure below shows a sector of a circle with radius 10 cm that cuts off an arc of length 5 cm.



The size of the angle θ correct to the nearest degree is:

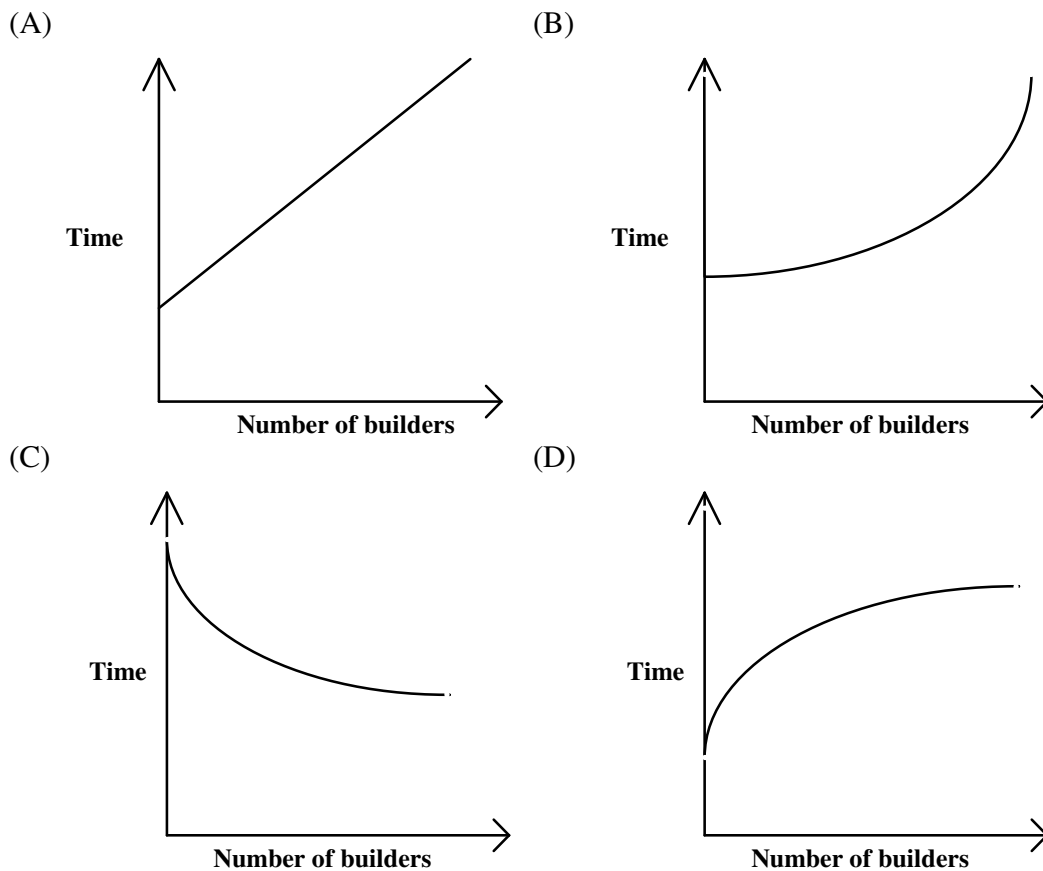
- (A) 17° (B) 18° (C) 28° (D) 29°
18. A researcher studies the association between the amount of study done by students and the achievement in exams. After drawing a scatterplot the researcher calculates that the correlation between the two variables is 0.85. The researcher concludes that:
- (A) There is a strong negative correlation between the variables; the more study the lower the exam results.
(B) There is a strong negative correlation between the variables; the more study the higher the exam results.
(C) There is a strong positive correlation between the variables; the more study the lower the exam results.
(D) There is a strong positive correlation between the variables; the more study the higher the exam results.
19. A rugby league goal kicker has a success rate of 80%. If the goal kicker has three shots at goal the probability that he is successful with exactly two of them is:
- (A) 12.8% (B) 38.4% (C) 51.2% (D) 60%

20. Nathan is a used car salesman who is paid commission on all sales made. Nathan is paid a retainer of \$1600 per month and a commission of 15% on the gross profit made by the car yard on sales made. The table below details Nathan's five sales made for a one month period.

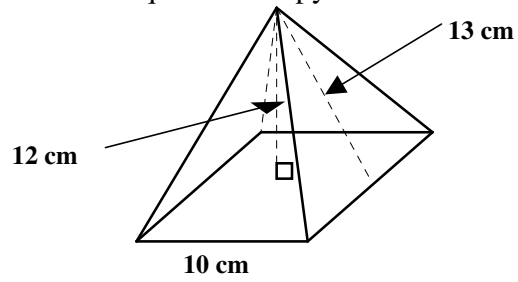
Car registration	Purchase price	Sale price
AB 12 FD	\$10 000	\$15 000
XYZ 456	\$8500	\$13 000
MRF 007	\$12 000	\$19 750
AA 97 IP	\$17 000	\$31 900
ZZZ 000	\$19 000	\$20 000

Nathan's earning for the month are

- (A) \$4972.50
(B) \$6572.50
(C) \$14 947.50
(D) \$16 547.50
21. The time taken to build a house varies inversely with the number of builders who work on the job. Which graph could be used to represent this?



22. The figure below shows a square based pyramid.



The volume of the pyramid is:

- (A) 340 cm^3
- (C) 400 cm^3

- (B) 360 cm^3
- (D) 433 cm^3

Section II

Total marks (78)

Attempt Questions 23 – 28

Allow about 2 hours for this section

Answer each question in a separate writing booklet.

Question 23 (13 marks)

- | | Marks |
|--|--------------|
| (a) The cost of a body board is \$407 including the 10% GST. Calculate the GST component in the price of the body board. | 1 |
|
(b) Alan works as a motorbike mechanic and is paid a normal hourly rate of \$19.40 for a 35 hour working week. Overtime is paid at a rate of time and a half and can only be worked in whole hours. | |
| (i) Calculate Alan's gross pay for a normal working week. | 1 |
| (ii) What is the hourly rate earned by Alan when he works overtime? | 1 |
| (iii) Calculate the total number of hours that Alan will need to work in order to earn in excess of \$1000. | 2 |
|
(c) Ben borrows \$12 000 to purchase a car. Ben is charged 8.8% p.a. simple interest over the five year term of the loan. | |
| (i) Calculate the simple interest payable on this loan. | 1 |
| (ii) Ben attempts to refinance this loan with a credit union. The credit union charges an interest rate of 9% p.a. however the interest is reducible. The table below shows the monthly repayment per \$1000 borrowed. | 2 |

Interest rate				
Year	7%	8%	9%	10%
3	\$30.88	\$31.34	\$31.80	\$32.27
4	\$23.95	\$24.41	\$24.89	\$25.36
5	\$19.80	\$20.28	\$20.76	\$21.25
6	\$17.05	\$17.53	\$18.03	\$18.53

Calculate the total amount that Ben would need to repay if he were to take out the loan with the credit union.

- | | |
|--|----------|
| (iii) Find the total saving made by taking out the loan with the credit union. | 2 |
|--|----------|

- (d) The table below shows Bella's fortnightly budget.

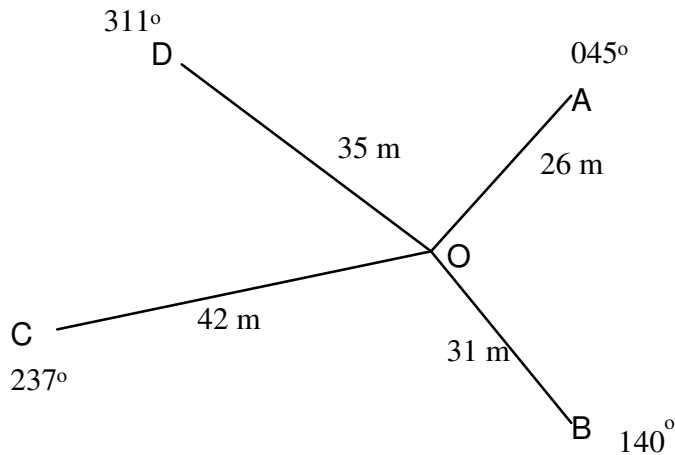
Income		Expenses	
Wages	\$1,750	Rent	\$580
		Bills	\$175
		Health fund	\$90
		Groceries	\$280
		Clothing	\$100
		Entertainment	\$80
		Car costs	\$270
		Savings	
TOTAL	\$1,750	TOTAL	\$1,750

- (i) Calculate the amount that should be entered in the budget under savings. **1**
- (ii) Bella needs to save \$5500 for a holiday, of which she has already saved \$1000. Calculate the number of weeks that it will take for Bella to save the rest of this money. **2**

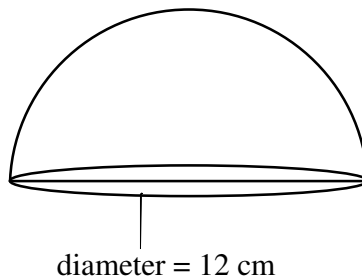
Question 24 (13 marks)

Marks
1

- (a) Convert a speed of 270 km/hr to m/sec
- (b) The figure below shows a radial survey of an area of land.



- (i) Find the size of $\angle DOA$ **1**
- (ii) Find the area of $\triangle AOD$ correct to the nearest square metre. **2**
- (iii) Use the cosine rule to find the distance AB correct to the nearest metre. **2**
- (c) The figure drawn below shows a solid plastic mould in the shape of a hemisphere. **3**



Find the surface area of the hemisphere correct to the nearest square centimetre.

- (d) Two warships are in the Pacific Ocean.
Ship A is at coordinates $(20^{\circ}\text{N}, 165^{\circ}\text{E})$.
Ship B is at $(20^{\circ}\text{N}, 170^{\circ}\text{W})$.
- (i) The local time at ship A is Wednesday 3:00 PM. Find the local time at the position of Ship B **2**
- (ii) A naval base is located at $(5^{\circ}\text{N}, 165^{\circ}\text{E})$. Find the distance of Ship A from the naval base in nautical miles. **2**

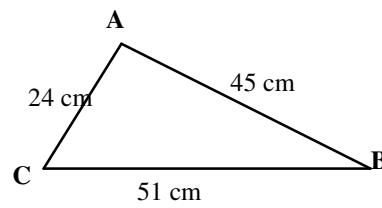
Question 25 (13 marks)**Marks**

- (a) The letters of the word PHILEDELPHIA are written on cards and shuffled. One card is selected at random.
- (i) Find the probability that a card with the letter P written on it is chosen. **1**
- (ii) Find the probability that a card is chosen with a letter that is not repeated in the word PHILEDELPHIA. **1**
- (b) A barrel contains 12 marbles 7 black and 5 white. From the barrel 3 marbles are selected, each marble not being replaced before the next one is drawn.
- (i) Find the probability that the first marble drawn is white. **1**
- (ii) Given that the first marble drawn is white what is the probability that the second marble drawn is also white? **1**
- (iii) By using a tree diagram or otherwise find the probability that at least one of the three marbles selected is white. **3**
- (c) An experiment is conducted to compare the benefits of having professional driving lessons have on young drivers attempting to get their licence. The results of their first driving test are shown in the two-way table drawn below.

	Passed	Failed	TOTAL
Professional lessons	96	34	
Taught privately	87	43	
TOTAL			

- (i) How many people were studied in the experiment? **1**
- (ii) How many drivers failed at their first attempt to get their licence? **1**
- (iii) A driver is selected at random from those who were part of the experiment for an interview. What is the probability that the driver selected had professional lessons but failed to get their licence at their first attempt? **1**

- (d) Consider the triangle ABC which is drawn below.



- (i) Use Pythagoras theorem to determine if the triangle is right angled. **1**
- (ii) Find the size of $\angle ABC$ correct to the nearest degree. **2**

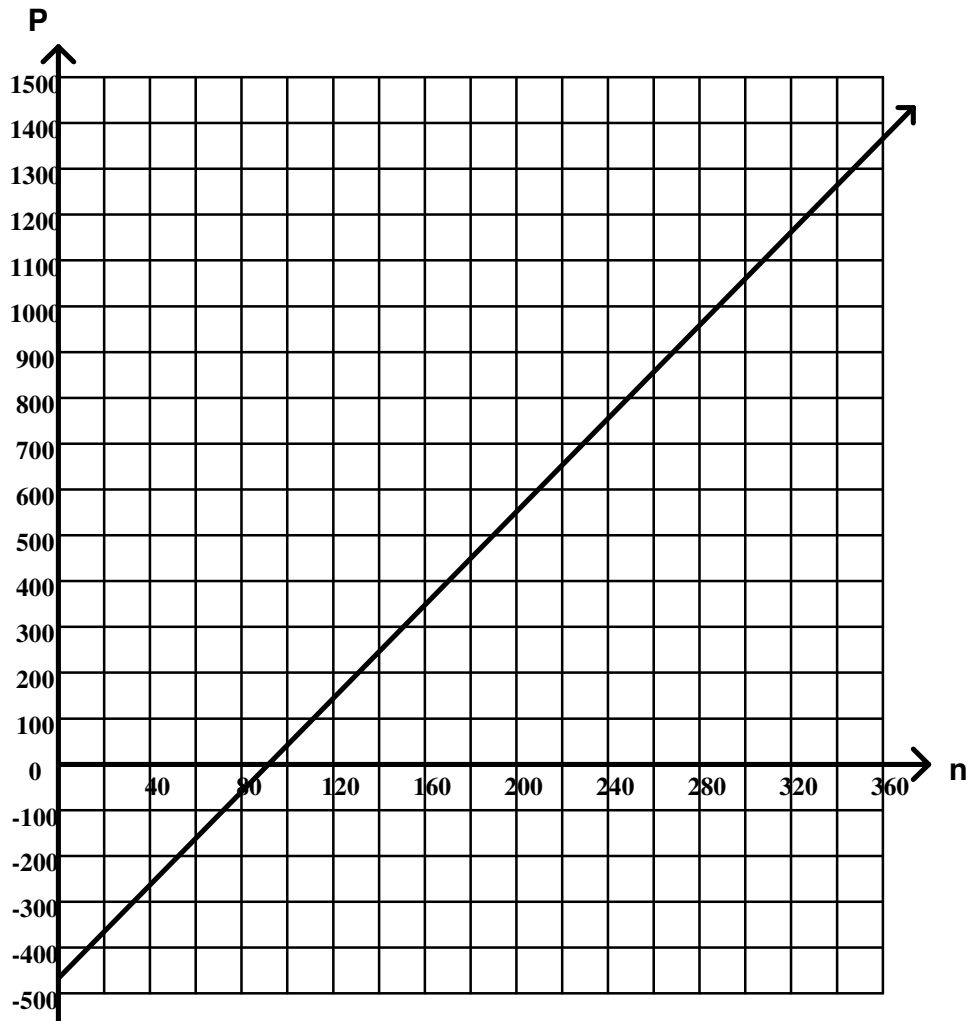
Question 26 (13 marks)

Marks

- (a) The directions on a bottle of medicine state the adult dose of the medicine is 60 mL. A child's dosage is found using the formula, $D = 75 - \frac{225}{A}$, where D is the child's dosage and A is the age of the child in years.
- (i) Calculate the dosage of the medicine that should be given to a 5 year old. **1**
- (ii) Use the formula to demonstrate that the medicine should not be given to a child that is 3 years old or under. **2**
- (iii) Use the formula to determine at what age a person can begin to take the adult dose of the medicine. **2**
- (b) The population of a city is 100 000 in 2007 and is growing at the rate of 5% per year. The population in any future year can be found using the formula $P = 100\,000(1.05)^n$, where n is the number of years elapsed since 2007.
- (i) Use the formula to estimate the population in 2017 to the nearest thousand. **1**
- (ii) Use a guess and check method to find the year in which the population will first exceed 250 000 people. **2**

Question 26 continues on page 18

- (c) The graph below shows the profit made by the organizers of a school dance.



- (i) Write a formula that will calculate the profit P made by the dance when “ n ” people attend. 1
- (ii) How many people will be needed to attend the dance in order for the organizers to break even? 1
- (iii) The maximum number of people that can attend the dance is 360. What profit will the organizers make if this number of people attends? 1
- (iv) The organizers need to make a profit of at least \$2000. At what price should tickets be sold for to make this profit if 360 people will still attend? The price of the ticket must be a whole dollar amount. 2

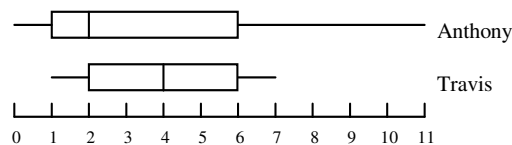
Question 27 (13 marks)

Marks

- (a) The scores below show the resting pulse rate of 12 people together with the number of chin-ups that they are able to do.

Resting pulse rate	70	65	68	84	58	62	74	70	81	77	64	68
Number of chin ups	8	11	9	6	15	12	7	9	3	5	13	11

- (i) Use the graph paper provided on page 22 to draw a scatter plot of this data. **2**
- (ii) Describe the correlation between the two variables as being either positive or negative and as being weak, moderate or strong. **2**
- (iii) Explain if there would be any causality in this result. i.e. Does the result in one variable cause the result in the other variable? **1**
- (b) The results of an I.Q. test show that I.Q.'s are normally distributed with a mean of 100 and a standard deviation of 15.
- (i) Jamie is known to have an I.Q. with a z -score greater than 1 and less than 2. Give a possible I.Q. that is within this range. **1**
- (ii) What percentage of the population would have an I.Q. in the same range as Jamie? **2**
- (c) The data below shows the number of goals kicked by Anthony and Travis for their AFL team.



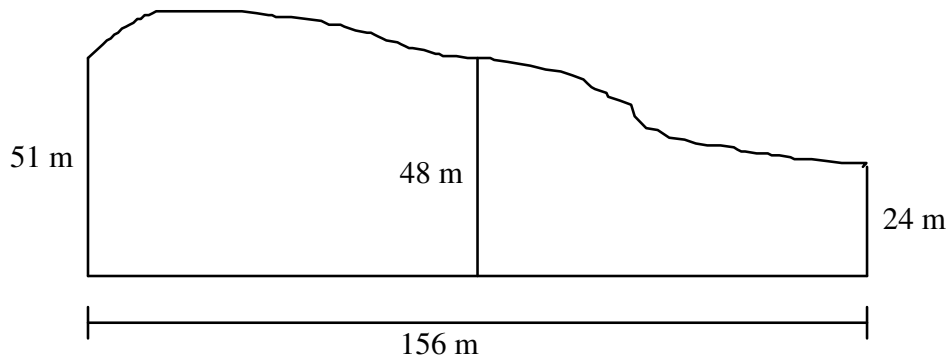
- (i) What was the highest number of goals kicked by either player? **1**
- (ii) Find
- (α) The range of Travis goals. **1**
- (β) The interquartile range of Travis goals. **1**
- (iii) Describe the skewness of the data set for each player. **2**

Question 28 (13 marks)

Marks

- (a) The figure below shows an irregular area of land.

2

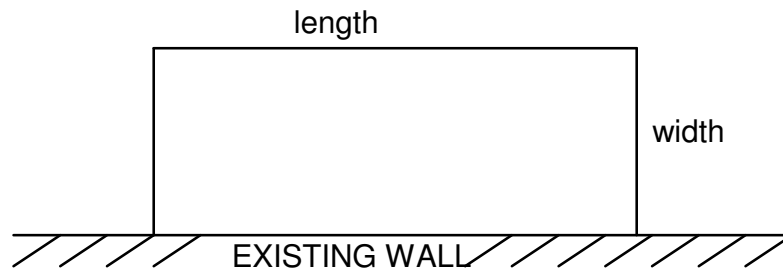


Use Simpson's rule to approximate the area of the block of land.

- (b) Aliesha, Billy, Andrew, Hayley, Zach and Emma each own an apartment in a small block of apartments. Two of them need to represent the group at a residents meeting.
- (i) In how many different ways can the two representatives be chosen? **1**
- (ii) Zach and Emma are chosen to join Kate, Nick, Thomas, Michelle and Daniela on a committee. The committee then needs to elect a President, Secretary and Treasurer. In how many different ways can these three positions be filled? **1**
- (iii) Because they live in the same complex Zach and Emma can not both be on the committee. Given this restriction in how many ways can the committee now be chosen? **2**

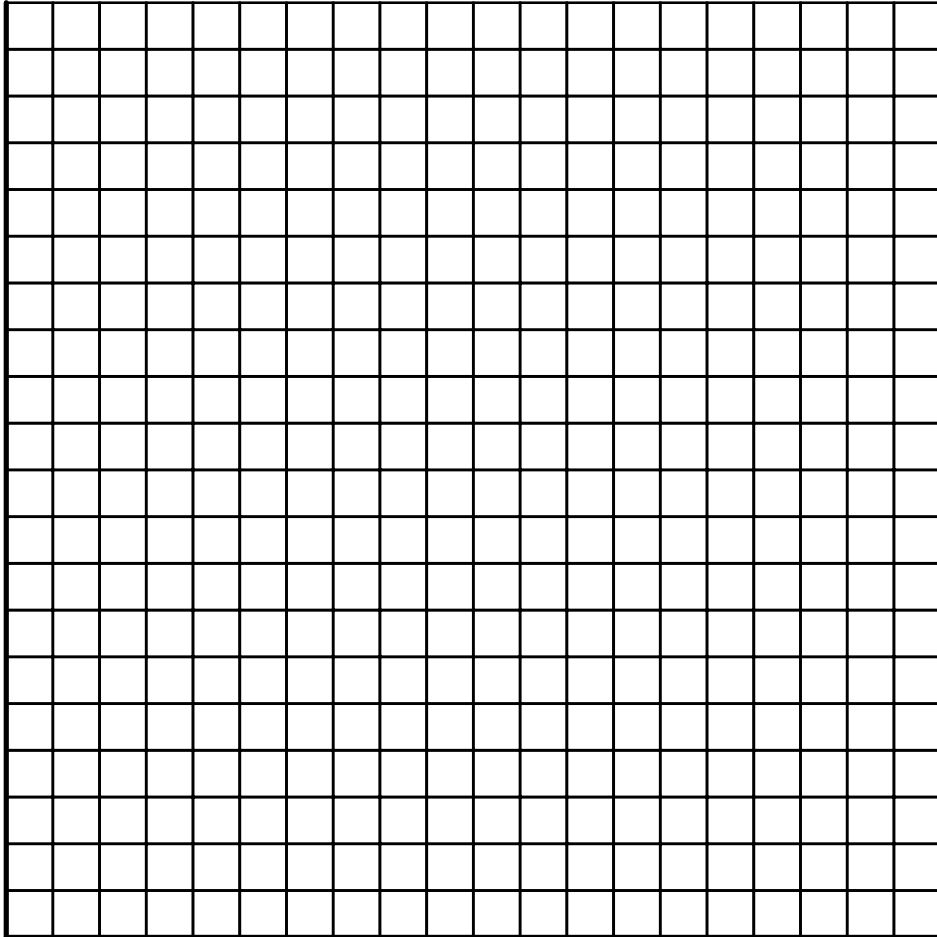
Question 28 continues on page 21

- (c) Zoran has to build a rectangular field using 300 metres of fencing using an existing wall as one side of the field.

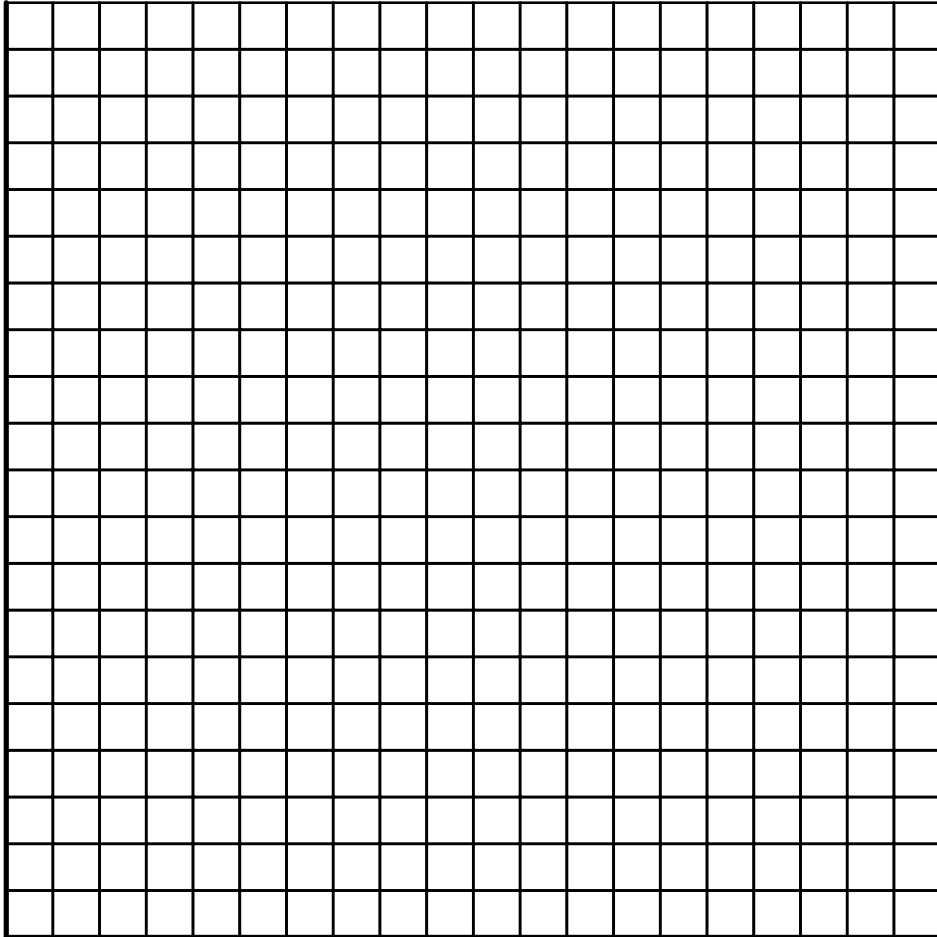


- (i) If the width of the field is to be ' x ' metres find an expression for the length of the field. 1
- (ii) Use your answer to (i) to show that the area of the field can be found using $A = 300x - 2x^2$. 1
- (iii) Complete the table below. 2
- | | | | | | | | |
|-----|---|----|----|----|-----|-----|-----|
| x | 0 | 20 | 50 | 75 | 100 | 125 | 150 |
| A | | | | | | | |
- (iv) Draw the graph of A against x using the graph paper provided on page 23. 2
- (v) Find the length and width of the field that will give Zoran a field of maximum area. 1

Graph paper for Question 27(a) – Please attach to your answer sheet.



Graph paper for Question 28(c) – Please attach to your answer sheet.



Formulae sheet

Area of an annulus

$$A = \pi(R^2 - r^2)$$

R = radius of outer circle

r = radius of inner circle

Area of an ellipse

$$A = \pi ab$$

a = length of semi-major axis

b = length of semi-minor axis

Area of a sector

$$A = \frac{\theta}{360} \pi r^2$$

θ = number of degrees in central angle

Arc length in a circle

$$l = \frac{\theta}{360} 2\pi r$$

θ = number of degrees in central angle

Surface area of a sphere

$$A = 4\pi r^2$$

Simpson's rule for area approximation

$$A = \frac{h}{3} (d_f + 4d_m + d_l)$$

h = distance between successive measurements

d_f = first measurement

d_m = middle measurement

d_l = last measurement

Volume

$$\text{Cone} \quad V = \frac{1}{3} \pi r^2 h$$

$$\text{Cylinder} \quad V = \pi r^2 h$$

$$\text{Pyramid} \quad V = \frac{1}{3} Ah$$

$$\text{Sphere} \quad V = \frac{4}{3} \pi r^3$$

A = area of base

h = perpendicular height

Mean of a distribution

$$\bar{x} = \frac{\sum x}{n}$$

$$\bar{x} = \frac{\sum fx}{\sum f}$$

x = individual score

\bar{x} = mean

Formula for z-scores

$$z = \frac{x - \bar{x}}{s}$$

s = standard deviation

Probability of an event

The probability of an event where outcomes are equally likely is given by

$$P(\text{event}) = \frac{\text{number of favourable outcomes}}{\text{total number of outcomes}}$$

Simple Interest

$$I = Prn$$

P = initial quantity

r = percentage interest rate expressed as a decimal

n = number of periods

Compound Interest

$$A = P(1 + r)^n$$

A = final balance

P = initial quantity

n = number of compounding periods

r = percentage interest rate per compounding period expressed as a decimal

Future value of an annuity

$$A = M \left\{ \frac{(1 + r)^n - 1}{r} \right\}$$

M = contribution per period, paid at the end of the period

Present value of an annuity

$$N = M \left\{ \frac{(1 + r)^n - 1}{r(1 + r)^n} \right\}$$

or

$$N = \frac{A}{(1 + r)^n}$$

Straight-line formula for depreciation

$$S = V_o - Dn$$

S = salvage value of asset after n periods

V_o = purchase price of the asset

D = amount of depreciation apportioned per period

n = number of periods

Declining balance formula for depreciation

$$S = V_o(1 - r)^n$$

S = salvage value of the asset after n periods

r = percentage interest rate per period, expressed as a decimal

Sine rule

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

Cosine rule

$$c^2 = a^2 + b^2 - 2ab \cos C$$

or

$$\cos C = \frac{a^2 + b^2 - c^2}{2ab}$$

Gradient of a straight line

$$m = \frac{\text{vertical change in position}}{\text{horizontal change in position}}$$

Gradient-intercept form of a straight line

$$y = mx + b$$

m = gradient

b = y-intercept

